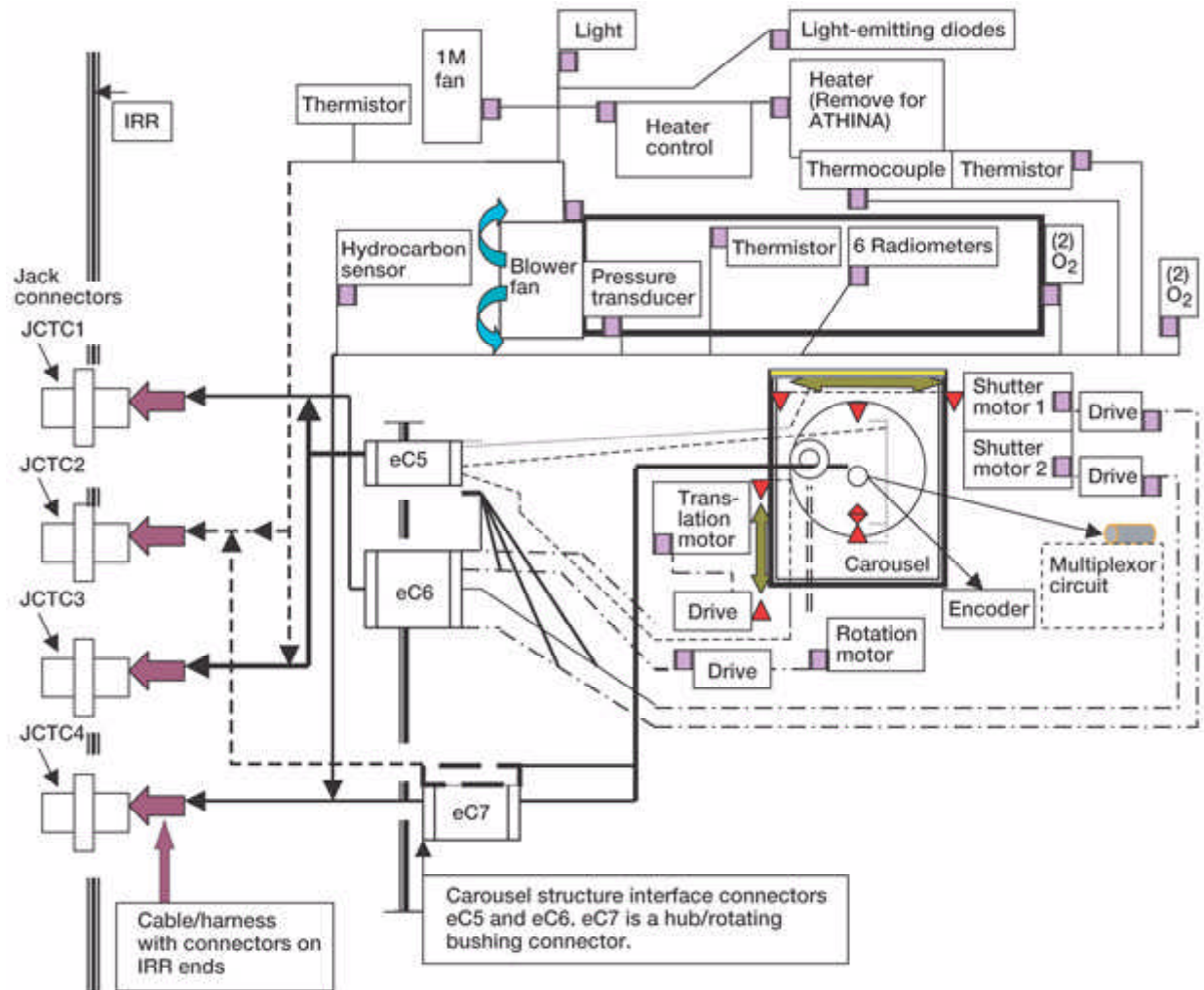


Modular Avionics Concept Developed for Microgravity Space Experiments--FEANICS

The Flow Enclosure Accommodating Novel Investigations in Combustion of Solids (FEANICS) is a facility being developed at the NASA Glenn Research Center that will be integrated into the Combustion Integrated Rack onboard the International Space Station. FEANICS will support various experimental studies of solid combustion in a microgravity environment. The experiments will vary, and the FEANICS facility hardware combined with the Combustion Integrated Rack hardware is designed to meet the science requirements of the individual experiments.

The principal investigator (PI) avionics box contains the electrical hardware that would run the various experiments and connectors that will interface to the Combustion Integrated Rack. This box is being designed to accommodate all the common-fuel experiments. In the case of the thick fuel experiments: Flow Ignition and Spread Test (FIST), Analysis of Thermal and Hydrodynamic Instabilities in Near-limit Atmospheres (ATHINA), and Radiative Enhancement Effects on Flame Spread (REEFS), the PI avionics box would have all the necessary control and instrumentation electronics to handle each particular experiment in turn and would use a one-harness-fits-all wiring approach.



FIST, ATHINA, and REEFS (thick fuel) insert wiring and connectivity in FEANICS.

JCTC1 to JCTC4, connectors carrying signals out of the IRR interface; 1M fan, air-mixing fan; B1 fan, blower fan for airflow control through the FEANICS insert tunnel; (2) O₂, two oxygen sensors.

Long description of figure The wiring and connectivity diagram illustrates the combustion chamber's internal harnessing and connectivity. It shows the IRR, four jack connectors, a cable/harness with connectors on IRR ends, thermistors, interface connectors, hydrocarbon sensor, fans, pressure transducer, light, heater control, heater, light-emitting diodes, shutter motors, drives, translation motor, rotation motor, carousel, encoder, and multiplexor circuit.

The circuits unique to a particular experiment would be active under that particular experiment's software control. Unused circuits would be dormant, although powered up. When the next type of experiment was run, its unique circuitry would be made active while the previous experiment's circuitry would be made dormant, and so on. Thus, when any of the common fuel experiment's chamber electrical devices or structure were changed

out, the PI avionics box electrical components would not have to be modified, just the experimental software would be changed via downloading.

The control signal and data connections between the PI avionics box and the combustion chamber's interface resource ring (IRR) would also not have to change with the various experimental runs. The common tunnel insert will contain all the electrical instrumentation and control devices for each experiment. The insert's cabling would be connected to dedicated connectors on the IRR. These would not be changed from experiment to experiment (FIST to ATHINA to REEFS), but the active pins in each connector would. This would depend on what PI avionics circuitry was active as mentioned earlier. Even though all the pins would be connected, only those pins associated with a particular experiment would carry signals. Similarly, the fuel carousel magazine would be changed from experiment to experiment, but its cable harness would connect to other dedicated IRR connectors handling thermocouple and radiometer data and motor/position switch plus igniter control signals. The number of thermocouple and radiometer data signals would change, but the motor/position switches would not. The PI avionics IRR-side connector pins handling the data signals would be wired to accommodate the worst-case number of signals. The corresponding carousel connector pins would be wired to handle only the necessary quantity of data signals for a particular experiment. Any unused signal/data pins would be terminated properly within the carousel's IRR-side cable harness (adding termination resistors or grounding unused pins, depending on the PI avionics input/output circuitry used).

The benefits of this "plug-n-play" accomplishment include the following:

1. Only one "master" harness and cable/connector set would be needed. This would lessen the mass needed to be transported to the space station and the onboard storage requirement. (A special harness would not be needed for each experiment.)
2. Because the PI avionics box would not have to be modified for each new experiment, it would require less astronaut hands-on time. This also would lesson onboard storage requirements (only spares for the existing PI avionics box would have to be stored, not the original components for each experiment).

Find out more about FEANICS

<http://microgravity.grc.nasa.gov/feanics/FEANICS.html>.

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